

WHAT IS CLAIMED IS:

1. A temperature-controlled hot edge ring assembly adapted to surround a semiconductor substrate support in a plasma reaction chamber, the assembly comprising:

a conductive lower ring;

a ceramic intermediate ring, the intermediate ring overlying the lower ring, the intermediate ring adapted to be attached via the lower ring to an RF electrode; and

an upper ring, the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of a plasma reaction chamber.

2. The assembly of Claim 1, wherein the intermediate ring is made of aluminum oxide.

3. The assembly of Claim 1, wherein the intermediate ring is made of quartz, silicon, silicon carbide or aluminum oxide.

4. The assembly of Claim 1, wherein the conductive ring is made of aluminum or alloy thereof.

5. The assembly of Claim 1, wherein the conductive ring is made of aluminum, aluminum alloy, brass, copper, copper alloy or stainless steel.

6. The assembly of Claim 1, wherein a lower surface of the upper ring is bonded to an upper surface of the intermediate ring via a thermally conductive elastomer.

7. The assembly of Claim 1, wherein the conductive ring has a plurality of holes configured to bolt the conductive ring to the RF electrode.

8. The assembly of Claim 1, wherein the conductive ring and the intermediate ring have a plurality of holes configured to bolt the intermediate ring to the conductive ring

9. The assembly of Claim 1, wherein the conductive ring has a substantially L-shaped cross-section.

10. The assembly of Claim 7, further comprising a first bolt having a tapered head at one end and a screw thread at the other end, the first bolt configured to bolt the conductive ring to the RF electrode.

11. The assembly of Claim 8, further comprising a second bolt having a head at one end and a screw thread at the other end, the second bolt configured to bolt the intermediate ring to the conductive ring.

12. The assembly of Claim 1, further comprising a conductive washer configured to receive a bolt having a head at one end and a screw thread at the other end, wherein the conductive washer is positioned between the upper ring and the intermediate ring.

13. The assembly of Claim 12, further comprising a plurality of holes in the upper ring, wherein the plurality of holes receive a cap, the cap having a vent hole configured to release pressure from within the edge ring assembly.

14. The assembly of Claim 1, wherein the upper ring is made of silicon, carbon, graphite, or silicon carbide.

15. The assembly of Claim 1, wherein the upper ring has a portion extending under a substrate when the substrate is located on the substrate support.

16. A plasma processing apparatus comprising:
 - a processing chamber;
 - a power source which energizes process gas in an interior of the processing chamber into a plasma state for processing a substrate;
 - a substrate support which supports a substrate within the interior of the processing chamber;
 - a conductive lower ring;
 - a ceramic intermediate ring, the intermediate ring overlying the lower ring, the intermediate ring adapted to be attached via the lower ring to an RF electrode;
 - and
 - an upper ring, the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of a plasma reaction chamber.
17. The apparatus of Claim 16, wherein the upper ring is bonded to the intermediate ring by a thermally conductive elastomer.
18. The apparatus of Claim 16, wherein the lower ring is made of aluminum or alloy thereof.
19. The apparatus of Claim 16, wherein the intermediate ring is made of aluminum oxide.
20. The apparatus of Claim 16, wherein the upper ring is made from a material selected from the group consisting of quartz, silicon, silicon carbide, graphite and aluminum.
21. The apparatus of Claim 16, wherein the plasma chamber is a semiconductor plasma etching apparatus.

22. The apparatus of Claim 16, further comprising a quartz outer ring surrounding the upper ring, the intermediate ring, the lower ring and the RF electrode.

23. A method of reducing process drift on a plurality of substrates in a plasma processing system comprising:

positioning a substrate in a plasma processing apparatus comprising:

a processing chamber;

a power source which energizes process gas in an interior of the processing chamber into a plasma state for processing a substrate;

a substrate support which supports a substrate within the interior of the processing chamber, the substrate support having an upper surface; and

an edge ring assembly comprising:

a conductive lower ring;

a ceramic intermediate ring, the intermediate ring overlying the lower ring, the intermediate ring adapted to be attached via the lower ring to the power source; and

an upper ring, the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of the processing chamber;

supplying process gas to the chamber;

forming a plasma adjacent the upper surface of the substrate support; and

sequentially processing a plurality of substrates in the plasma processing apparatus, wherein the temperature of the upper ring is substantially cooled to an initial temperature after a first substrate is removed from the substrate support and before a subsequent substrate is placed on the substrate support to reduce process drift.

24. The method of Claim 23, wherein the substrate comprises a semiconductor wafer and the processing step comprises etching the semiconductor wafer with the plasma.